

# Interoperability Testing and the New Acquisition Guidance

## Joint Interoperability Test Command Embraces the Ideals

DENNY F. BEAUGUREAU • CLAYTON K. HASHIMOTO •  
RANDON R. HERRIN

On Oct. 30, 2002, Deputy Secretary of Defense Paul D. Wolfowitz cancelled the existing defense acquisition guidance documents DoDD 5000.1, DoDI 5000.2, and DoD 5000.2-R. In his memorandum, Wolfowitz stated that his objectives were to foster efficiency, creativity, and innovation, and to streamline mandatory acquisition procedures and processes to meet warfighter needs. The interim guidance directs that “continuous examination and adoption of innovative practices” be encouraged and that spiral development be the preferred process in any evolutionary acquisition strategy. The interim guidance also provides for no more than two levels of review between the program manager (PM) and the milestone decision authority (MDA). This will likely reduce the PM’s accountability reporting responsibilities and allow more time for program management.

Many in the acquisition community are awaiting the final guidance, which is to be included in documents jointly published by the Director, Operational Test and Evaluation (DOT&E), the Assistant Secretary of Defense for Networks and Information Integration (ASD NII), [previously Command, Control, Communications and Intelligence (ASD C3I)], and the Under Secretary of Defense, Acquisition, Technology and Logistics (USD AT&L). The anticipated changes will prove particularly interesting for



Phyllis Anderson describes aspects of a Tactical Data Link Network to JITC Deputy Commander Denny Beaugureau, who comments that “early and continuous involvement of JITC and the existence of joint Interoperability Key Performance Parameters (IKPPs) and Information Exchange Requirements (IERs) are key to executing a successful and substantive interoperability test.”

any major automated information system (MAIS) or major defense acquisition program (MDAP) PM whose program has ties to weapons systems or command and control systems. **[Editor’s Note:** Since this article was written, the new acquisition guidance documents have been published and several key DoD interoperability certification policy documents continue to be revised, but article contents are still valid.]

### Many “Old” Requirements Still Apply

In the meantime, a number of the requirements from the superseded 5000-series documents still apply to the operations of the acquisition community. Modeling and simulation (M&S), for example, are still to be used throughout the concept and system development phase and to be integrated in all testing activities. Simulation-based ac-

*Beaugureau, a retired naval officer, has 13 years’ experience dealing with interoperability and is currently the JITC deputy commander. Hashimoto is a senior communications-electronics engineer with JITC. He has directed significant conformance, standards development, interoperability, and operational tests undertaken by the JITC. Herrin is JITC’s Combat Systems branch chief, Fort Huachuca, Ariz. A former Air Force officer, he has more than 23 years of NSS and ITS research, development, test and evaluation, and acquisition experience.*

quisition (SBA) principles, along with performance and knowledge-based concepts, are still required. The use of integrated product teams and integrated joint architectural views, and emphasis on post-deployment sustainment activities are also included in the interim guidance.

A program's requirements for reviews and milestones have not changed and may, in fact, have increased with iterative demonstrations, assessments, and production decisions within the evolu-

main essential to the fielding of any program having ties to a national security system (NSS) or an information technology system (ITS).

#### Expanded JITC and Testing Community Involvement

The newly revised acquisition process gives the testing community—a key element of the acquisition force—the opportunity to take the initiative and become an active participant in any phase of the acquisition cycle from concept exploration to production and deploy-

has been mistakenly associated with technical interoperability testing and certification alone, we have, in reality, always looked at interoperability as consisting of three primary factors—people, equipment, and procedures—that are similar to the current joint community emphasis on all aspects of the doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) concept and its effects on

**Testing organizations must be involved early in the concept exploration phase of a program to ensure that changing requirements are consistently evaluated and cross-referenced up to and through the production and deployment phases.**



The 9,500-foot-high Huachuca Mountains provide a dramatic backdrop for a variety of JITC test shelters and antennas, including high-gain spiral SATCOM UHF antennas, line-of-sight Army-Navy TRC-170 antennas, and a 20-foot parabolic Army-Navy transportable SATCOM-85B antenna.

tionary acquisition process. Changes in the requirements documentation include replacing the mission needs statement (MNS) and the operational requirements document (ORD) with an initial capabilities document (ICD) prior to Milestone A and with a capabilities development document (CDD) prior to Milestone B. The capabilities production document (CPD) is now required after critical design review (CDR) in the system development and demonstration phase, which precedes Milestone C and the production and deployment phase. And finally, meeting information assurance and interoperability objectives re-

ment. The Joint Interoperability Test Command (JITC), historically associated with interoperability certifications, is taking advantage of this opportunity to ensure that it is involved early on and remains involved continuously throughout different aspects of the acquisition cycle. (See next pages "Inside the Joint Interoperability Test Command" for an overview of JITC's charter and multifaceted role in support of the acquisition process.)

For years now, JITC has been implementing many of the new requirements in Wolfowitz's guidance. Although JITC

interoperability. JITC considers interoperability as more than the exchange of critical information between two military service systems. Vital to interoperability is a holistic approach that synergizes training, procedures, terminology, and joint operational implementation of systems among the different military services and federal agencies.

# INSIDE THE JOINT INTEROP

JITC is the only DoD agency mandated and authorized to certify joint interoperability of NSS and ITS programs to the Joint Staff. In addition, JITC is the operational test agency (OTA) for joint NSS and ITS programs developed by the Defense Information Systems Agency (DISA) and other joint agencies. We provide DT services and serve as the responsible test organization for various program offices. As such, we plan, direct, and execute a variety of T&E activities outside the bounds of formal DT and OT.

JITC's charter responds to the warfighter in a variety of ways. We routinely provide on-the-spot evaluations of problem areas and viable mission-oriented solutions for the combatant commanders during exercises and contingency operations. We can also reconstruct and remotely emulate tactical and strategic NSS and ITS operational architectures in test beds and laboratories to address and resolve interoperability issues from around the globe.

JITC is a direct reporting unit of DISA, the agency responsible for information technology and for centrally managing major portions of the global information grid. As DISA's OTA, we respond to the Office of the Secretary of Defense (OSD) Director of Operational Test and Evaluation (DOT&E). The DISA director reports to the ASD NII. In addition, the Chairman of the Joint Chiefs of Staff may task the DISA director to assist the four military services, combatant commanders, and various DoD or federal agencies (Figure 1).

JITC is characterized by several unique roles in support of DISA and the warfighter (Figure 2). As well as the OTA for DISA-managed programs, we also serve as the OTA for other DoD agencies, such as the Defense Logistics Agency, the Defense Finance and Accounting Service, and the Defense Commissary Agency.

As the only non-service element of the Major Range and Test Facility Base (MRTFB), JITC deals directly with vendors to test and certify their products on a reimbursable basis. The result of this early involvement is usually the deployment of more effective systems at lower costs. A current example of this is our work with the

electronic business/electronic commerce (EB/EC) program. Since 1998, we have been assisting defense contractors who do business electronically with the DoD by pre-validating data and injecting them through a test environment similar to the operational environment. We also assist government users in transitioning to new electronic systems.

With a broad range of testing expertise (see sidebar, p. 20) and dedicated test bed facilities, the global reach of DISA and JITC spans the entire spectrum of DoD, federal government, commercial industry, and allies in support of C2, intelligence, and defense acquisition and logistics

excellence initiatives. Because of the large number and diverse types of NSS and ITS hardware necessary for testing, JITC conducts a significant amount of testing in a distributed environment. We have incorporated a risk mitigation network to provide the capability to test systems with minimal impact to operational networks. Many of our test beds are currently linked to other service and DoD agency test beds. One of our most active distributed networks sup-

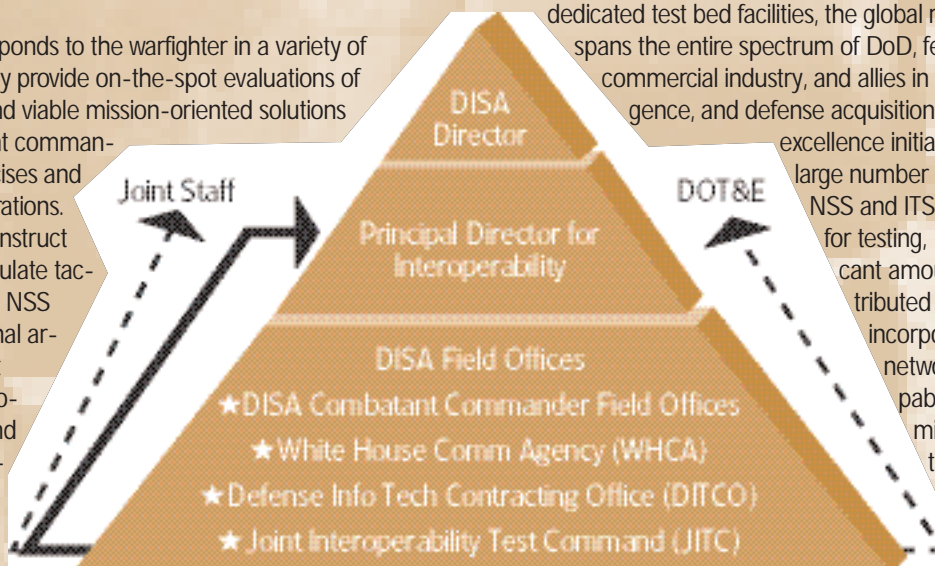


FIGURE 1. Direct (DISA) and Indirect (Joint Staff and DOT&E) JITC Reporting Structure

ports C2 TDL testing for Joint Theater Air and Missile Defense (JTAMD) (Figure 3). JITC can also link to the Combined Federated Battle Lab Network for the distributed interoperability assessments of non-U.S. equipment and systems.

The Joint Distributed Engineering Plant (JDEP), a DoD- and service-funded, DISA-managed, JITC-supported initiative, is intended to meet the development and testing challenges of supporting knowledge-centric warfare based on joint task force interoperable system capabilities. JDEP facilitates the replication of joint operational environments through the use of existing distributed test capabilities across DoD and industry, creating a true DoD enterprise infrastructure to support developers, testers, and warfighters in addressing mission area interoperability issues. JITC operates as the JDEP coordination and technical support organization; in this capacity, our functions, in partnership with JDEP users, include infrastructure investments programming, event planning, and execution. JDEP's maturation and success will ultimately depend on the cooperation of the developer, tester, and user communities, along with an ability to be responsive in solving warfighter interoperability challenges.



# ERABILITY TEST COMMAND

FIGURE 2. JITC's Unique Warfighter Roles

DoD's sole joint interoperability certifier

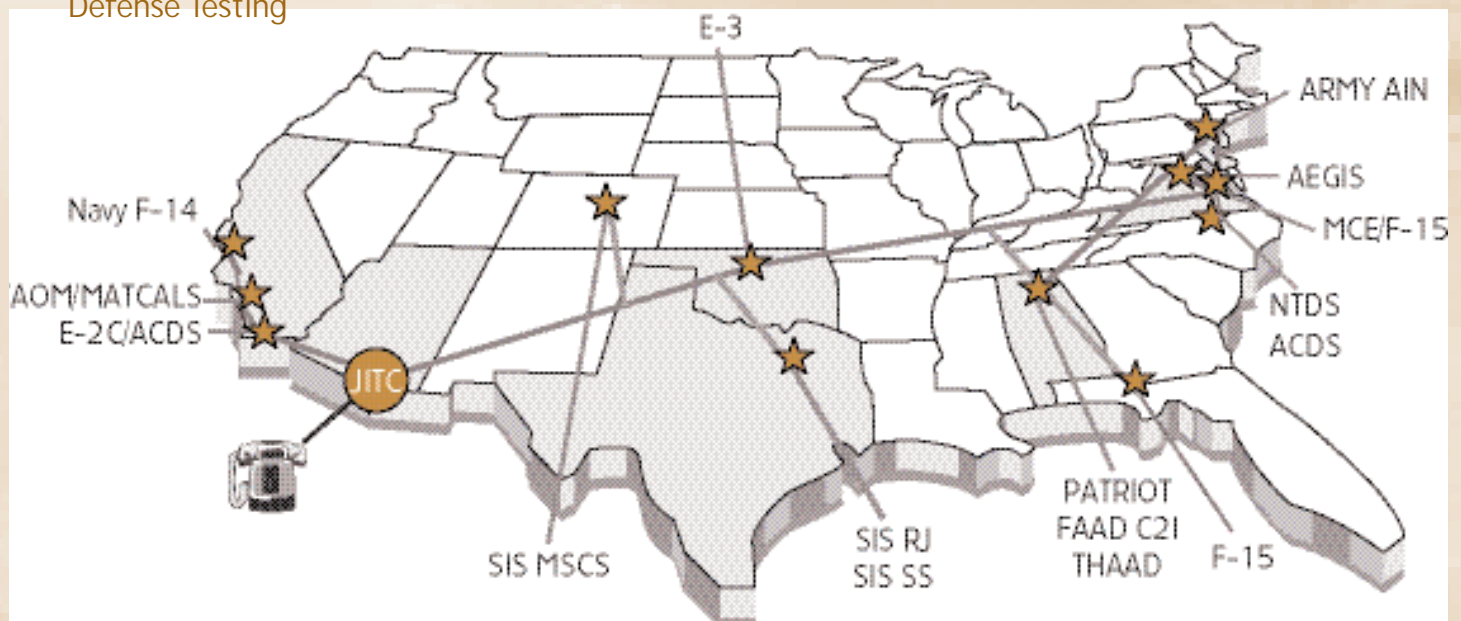
Operational Test Agency for many DoD elements

Major Range & Test Facility Base (MRTFB) element

Executive Agent for various tests (NIMA, EKMS, CDL, among others)



FIGURE 3. Tactical Data Link Distributed Network Used for Joint Theater Air and Missile Defense Testing



## JITC CAPABILITIES

The following list, which is by no means all-inclusive, presents many of JITC's areas of testing expertise and dedicated test bed facilities.

- Asynchronous transfer mode (ATM)
- Combined interoperability testing
- Command and control (C2)
- Defense Information System Network (DISN)
- Defense Message System (DMS)
- Defense Red Switch Network (DRSN)
- DoD Intelligence Information System (DODIIS)
- Defense Finance and Accounting System (DFAS) corporate information infrastructure
- Electronic business/electronic commerce (EB/EC)
- Global Command and Control System (GCCS)
- Global Combat Support System (GCSS)
- High-frequency test facility
- Information assurance (IA)
- Joint Theater Air and Missile Defense (JTAMD)
- National Imagery Transmission Format Standard (NITFS)
- Missile defense
- Satellite communications (SATCOM)
- Security management infrastructure (public key infrastructure [PKI])
- Tactical communications
- Tactical data link (TDL)
- Telemedicine
- U.S. message text format (USMTF)
- Unmanned aerial vehicle (UAV)
- Global information grid-bandwidth expansion (GIG-BE)

The importance of this is clearly illustrated by the following experience. A few years ago, in a joint exercise supported by JITC, a weapons controller of an anti-missile weapon system from one service used the command "terminate" to stop on-going and defensive action. In the course of the exercise, JITC discovered that the battery commander for another air defense unit (and a different service) used the same command, "terminate," to shoot down any incoming track, whether identified as friendly or not. Confusion over the different interpretations of the term could have had serious friendly fire repercussions in a hostile environment involving joint forces.

### The Interoperability Testing Process

For the past seven years, JITC has been active in validating and verifying program and system requirements in collaboration with the Joint Staff (JS). To ensure successful developmental testing (DT) and operational testing (OT), all involved must fully understand what is required in order that the product or system, when developed and fielded, performs its operational functionalities and capabilities as the user expects. With full definition and understanding of the requirements, testers can develop criteria to evaluate them.

Establishing the interoperability testing process is nearly identical. Testable requirements associated with the interoperability, functionality, and capability of a product or system interfacing with another product or system must be validated and evaluated under operational conditions. Central to the interoperability requirements validation phase is the establishment of interoperability key performance parameters (IKPPs) and information exchange requirements (IERs). DoD interoperability certification policy document changes are incrementally replacing IKPPs with "Net-Ready" KPPs (NR-KPPs) and IERs with key interface profiles (KIPs). To facilitate the incremental, evolutionary fielding concept, interoperability requirements in the form of IKPPs/NR-KPPs and IERs/KIPs must be tested and evaluated using M&S tools, prototypes, low

rate initial production (LRIP) items, and finally with the full-rate production-deployable versions. Following those efforts, interoperability evaluations must continue with post-deployment enhanced product releases beyond full operational capability (FOC).

### Life Cycle Involvement

In line with the new acquisition guidance, testing organizations must be involved early in the concept exploration phase of a program to ensure that changing requirements are consistently evaluated and cross-referenced up to and through the production and deployment phases. In an approach similar to the involvement with requirements, JITC's capabilities extend from concept exploration (by means of M&S) and evaluation of engineering prototypes, to standards and product conformance testing, to more rigorous hardware-in-the-loop (HWIL) evaluations. All of the preceding eventually lead to operational tests and evaluations (OT&Es) complemented by evaluation data from live field exercises, demonstrations, and contingency support.

The complexity of test activities parallels product maturation phases where more M&S is used early on during initial testing events, and environments (for example, laboratory conditions, HWIL evaluations) are controlled and easier to duplicate. As the systems and products approach their fielding decision milestone, test events evolve and expand to emulate more realistic operational environments. Since these environments will be harder to control, reduced M&S involvement and dependency on stimulators and simulators, as well as considerably more human participation are needed. Involvement of test organizations from concept development to final deployment assists in the early identification and correction of problem situations. It is this early and entire life cycle involvement concept that test organizations should adhere to and PM offices adopt.

### Successful Endeavors

For JITC, the tactical data link (TDL) area is one prime example of the life

cycle involvement concept in action. We have an active TDL test program that starts with initial HWIL platform interoperability evaluations of Link 11, 11B, and 16 messages. These same platforms are then evaluated during complex live exercises or demonstrations where the message formats are tested in an operational environment.

Another example of successful continuous and evolutionary developmental and operational test activities is the Defense Message System (DMS) program. By JITC involvement early in DT, we were able to complete nearly 35 percent of the OT activities in the DT, thereby reducing cost and test time. We were also actively involved with the requirement generation process of DMS. The initial requirements were not well defined, but with our input, they evolved into testable criteria for functionality and capability that were adapted to meet each incremental fielding phase. JITC's continuous and early involvement contributed significantly to the successful testing of both the TDL and DMS programs.

#### Enhanced Risk Management

Risk management is a critical PM responsibility, and like all PM responsibilities, it involves trade-offs. Many—but unfortunately not all—PMs have learned that early and continuous involvement of testing organizations greatly minimizes risks and ensures that their programs provide operational utility.

While the test community can be instrumental in reducing risk and ensuring successful achievement of program objectives, part of the process entails trading off cost, schedules, and resources against confidence levels. Any test program generally involves an investment of time and resources (people, money, facilities, etc.). The key to managing risk is achieving a balance between sufficient testing (investment) and level of confidence. To determine that a command and control (C2) system is ready for guaranteed risk-free fielding, all system functionalities must be tested against every conceivable peacetime, transi-

tional, and wartime scenario. Obtaining such an exceptional level of confidence requires endless testing of functions and countless iterations at significant time and program costs. Normally a trade-off is established to balance affordable confidence against acceptable risk. However, any risk of failure that threatens the lives of our servicemembers or jeopardizes the ability to support critical operational missions must be thoroughly tested.

**Many—but  
unfortunately not  
all—PMs have  
learned that early  
and continuous  
involvement of  
testing  
organizations  
greatly minimizes  
risks and ensures  
that their programs  
provide operational  
utility.**

JITC uses a “test-for-success” concept as a guideline. Developers are encouraged to participate in test planning and testing activities. This cooperation frequently allows immediate identification, development, and implementation of needed fixes, and often reduces the overall test time and cost. To ensure affordable confidence, both the developer and the user must agree, prior to test, on the amount of testing necessary to determine if the risk of fielding a new system is offset by that system's demonstrated capabilities.

#### Joint Interoperability: an Increasingly Urgent Priority

The need for joint interoperable command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) capabilities has never been greater. World events have amply demonstrated that warfighting using network-centric command and control has become both the norm and the key to dominating the information battlespace of the 21<sup>st</sup> century. Joint interoperability continues to be an increasingly urgent priority for DoD as a direct consequence of forward-looking warfighting doctrine that mandates extensive joint, combined, and coalition operations. These conditions represent significant challenges to the weapons system development and testing communities, and call for a flexible, responsive, cost-effective, reliable, and reusable testing architecture that can be employed to develop interoperable systems that assure dominance of the information battlespace.

In a perfect acquisition program world, there would be an infinite amount of time and an inexhaustible supply of resources available; requirements would be clearly stated and understood; and PMs would implement and field every program on schedule with the highest levels of confidence and the least amount of risk. We live in the real world, however, where the opposite is all too often the case. Trade-offs are essential, requirements are evolving, technology is advancing, and resources are limited. The guidance outlined by Wolfowitz has provided an opportunity for test organizations to be equal participants in the already challenging acquisition process. Engaging the test organization early as an equal partner results in less risk, enables PMs to make more timely and informed decisions, and creates greater confidence that products and systems will be fielded as designed.

**Editor's Note:** The authors welcome questions and comments on this article. Beaugureau can be reached at [beaugurd@fhu.disa.mil](mailto:beaugurd@fhu.disa.mil), Hashimoto at [hashimoc@ncr.disa.mil](mailto:hashimoc@ncr.disa.mil), and Herrin at [herrinr@fhu.disa.mil](mailto:herrinr@fhu.disa.mil).